Appl. No. 10/774,639
Amdt. dated May 25, 2005
Reply to Office action dated January 25, 2005

AMENDMENTS TO THE SPECIFICATION

Please replace paragraph [0019] with the following amended paragraph:

[0019] Another aspect of the present invention relates to a method of evaluating water quality including the steps of delivering water to be evaluated to a water reservoir and pumping the water from the water reservoir to an exposure chamber housing at least one aquatic organism. Electrical signals generated by the aquatic organism are measured, and a plurality of ventilatory parameters of the aquatic organism are determined based on the electrical signals. The water in the exposure chamber is then drained back into the reservoir. The water is then pumped from the reservoir back into the exposure chamber for further analysis. Alternatively, the water in the reservoir is pumped from the reservoir through a source water outlet where it exits the system.[[-+]]

Please replace paragraph [0026] with the following amended paragraph:

[0026] Figure [[3a]] <u>3A</u> is a top view of a water analyzer conversion sleeve of a biomonitoring system made in accordance with an embodiment of the present invention.

Please replace paragraph [0027] with the following amended paragraph:

[0027] Figure [[3b]] <u>3B</u> is a side view of a water analyzer conversion sleeve.

Please replace paragraph [0029] with the following amended paragraph:

[0029] Figure [[5a]] <u>5A</u> is a perspective view of an electrode assembly of a biomonitoring

system made in accordance with the present invention.

Please replace paragraph [0030] with the following amended paragraph:

[0030] Figure [[5b]] 5B is a vertical cross-sectional view of an electrode assembly of a biomonitoring system made in accordance with the present invention.

Please replace paragraph [0032] with the following amended paragraph:

[0032] Figure [[7a]] 7A is a top view of a reservoir of a biomonitoring system made in accordance with the present invention.

Please replace paragraph [0033] with the following amended paragraph:

[0033] Figure [[7b-7c]] 7B-7C are side views of a reservoir.

Please replace paragraph [0034] with the following amended paragraph:

[0034] Figure [[8a]] 8A is a perspective view of a heat exchange manifold assembly of a biomonitoring system made in accordance with the present invention.

Please replace paragraph [0035] with the following amended paragraph:

[0035] Figure [[8b]] 8B is a side view of a shutoff valve of a heat exchange manifold assembly.

Please replace paragraph [0038] with the following amended paragraph:

[0038] Figures [[11a-11b]] 11A-11B display a flowchart illustrating a process for distinguishing between coughs, whole body movement, changes in ventilatory rate, and other behavior to determine when an alarm state occurs in the present invention.

Please replace paragraph [0043] with the following amended paragraph:

[0043] The water to be analyzed flows through the water source inlet 13 and then passes through an inlet conduit 14 and into a water reservoir 16, which is preferably disposed within first housing 11. As shown in Fig. 7, the reservoir 16 includes a lid 17, a reservoir inlet 18 through which the source water enters, and a reservoir outlet 19. A reservoir overflow pan 20 catches water which may be leaking from pipes or from other areas within the entire system 10 and directs the water outside of the system via an overflow drain 21 which preferably includes a conduit extending outside of housing 11. The water is contained in the water reservoir 16 prior to being tested. The reservoir 16 volume may vary depending upon the dimensions of the housing 11. The water reservoir 16 preferably has a volume between about [[1 and about 4]] one and about four gallons. Preferably, the water reservoir 16 has a volume between about [1 and about 2]] one and about two gallons.

Please replace paragraph [0044] with the following amended paragraph:

[0044] The water may then be pumped out of the water reservoir 16 through outlet 19 to a water quality sensor 22 via a pump 24. The water quality sensor is preferably located outside of the housings 11 and 12. Specifically, the water may be pumped from

the reservoir 16 through a sensor inlet conduit 28 and into a water quality cup 30. Any pump known to those having skill in the art may be used in the present invention. The water contained in the water quality cup 30 is analyzed by the water quality sensor 22. The water quality sensor [[20]] 22 monitors and analyzes various parameters of the water including, but not limited to dissolved oxygen level, temperature, pH, and conductivity. Through the use of a controller 32 these parameters may be monitored and compared to present alarm limits.

Please replace paragraph [0046] with the following amended paragraph:

[0046] The pivotal movement of the water quality sensor 22 allows for flow-through operation and calibration of the system 10 without the laborious task of disconnecting and remounting the sensor. The pivotal rotation of the water quality sensor 22 also enables one individual to perform maintenance of the sensor without an additional clamp setup or additional individual to hold it. [[The]] Pivotal movement of calibration bracket 34 [[pivot]] allows for positioning of the sensor 22 in a manner that does not trap air within the sensor which would prevent proper water monitoring.

Please replace paragraph [0047] with the following amended paragraph:

[0047] Referring to Figs. [[3a – 3b]] 3A-3B, a water analyzer conversion sleeve 54 may be utilized to adapt the calibration bracket 34 to fit different models of water quality sensors 22. The water analyzer conversion sleeve 54 is [[preferablycylindrical]] preferably cylindrical in shape and comprises an orifice 55 inside which a water quality

sensor 22 fits. The conversion sleeve 54 includes at least one slot 56 which allows the sleeve to be partially opened and closed. The water analyzer conversion sleeve 54 may be placed inside of the calibration bracket 34, thereby allowing water quality sensors 22 having smaller diameters to fit inside of the calibration bracket. The slots 56 located in the conversion sleeve 54 allow the sleeve to be partially opened during the placement of a water quality sensor 22 within the sleeve. When the clamp 40 on the calibration bracket 34 is closed and tightened, the slots 56 located in the conversion sleeve 54 are also closed.

Please replace paragraph [0048] with the following amended paragraph:

[0048] Returning to Fig. 1, once the water is analyzed by the water quality sensor 22, it exits the sensor via a sensor outlet conduit 58 which is connected to a water distribution manifold 60. The water passes through the water distribution manifold 60 and into an exposure chamber 62 containing one or more aquatic organisms 64, such as fish. The exposure chamber 62 may include one or more chamber compartments 66 for holding an individual fish 64 <u>as shown in Figure 4</u>, wherein the water distribution manifold 60 distributes water into each chamber compartment. For example, in a preferred embodiment, the exposure chamber 62 includes eight chamber compartments 66, and the water distribution manifold 60 distributes water into each chamber compartment. Eight fish 64 exposed to the same water provide a statistically significant sample group of organisms to determine whether physiological stress has occurred due to the water quality as opposed to illness in, or injury to, an individual fish that was caused by

something other than water quality. For example, in the preferred embodiment, the system 10 includes a total of two exposure chambers 62 wherein each exposure chamber includes eight chamber compartments 66. Accordingly, one group of fish 64 may be exposed to a water sampling source and the other group of fish may be exposed to control water. Alternatively, one group of fish 64 may be monitored while another group is being acclimated or monitored for benchmark data prior to exposure. Furthermore, if two portable systems 10 of the present invention are utilized, a total of four exposure chambers 62, each having eight chamber compartments 66 allow for simultaneous monitoring of up to thirty-two fish.

Please replace paragraph [0051] with the following amended paragraph:

[0051] Figs. [[5a and 5b]] <u>5A and 5B</u> are respectively a top perspective view and a vertical cross-sectional view of an example of an electrode assembly 80 which can be used as one or both electrodes 67 and 68. The illustrated assembly 80 includes an electrically conducting electrode plate 81, a spacer 82 for positioning the plate 81 with respect to the interior of an exposure chamber 62, and a bolt 83 for securing the assembly 80 to the exposure chamber 62. The illustrated plate 81 is an elongated rectangular strip of graphite with a width of 0.8 inches and a length of 3.5 inches, although the dimensions of the plate 81 are not critical. The spacer 82, which is made of acrylic or other electrically insulating material, is secured to the plate 81 by any convenient manner, such as by bonding. It has a central bore for receiving the bolt 83, which in this example is made of nylon or other electrically insulating material. The bolt

83 has a central bore through which can pass a lead wire 84 which is electrically connected to the plate 81 in any manner which assures good electrical conductivity, such as by using a conductive bonding material 85 of silver epoxy or other suitable material. The interior of the spacer 82 between the head of the bolt 83 and the plate 81 may be filled with a nonconductive epoxy 86 or other nonconductive material in order to make the interior of the spacer 82 water tight and to increase the structural stability of the connection between the lead wire 84 and the plate 81. The threads of the bolt 83 which extend outside of the spacer 82 may be passed through a corresponding opening in the exposure chamber 62 and affixed with a nut on the exterior of the exposure chamber 62 to secure the electrode assembly 80 in place. Each spacer 82 is sufficiently long that at least one face of the corresponding plate is immersed in the water in the exposure chamber 62. The lead wire 84 can be connected to the plug 73 so that the output signals from the assembly 80 can be supplied to the amplifier 69 or to external equipment if desired.

Please replace paragraph [0061] with the following amended paragraph:

[0061] The system 10 of the present invention may also include a heater/chiller unit for controlling the temperature of the water being analyzed. By controlling the temperature of the water within the exposure chamber 62, a stable environment is provided for the aquatic organisms 64 being analyzed. Accordingly, the integrity of the ventilatory and body movement signals being collected from the organisms 64 is maintained. As illustrated in Figs. 1 and 7, the heater/chiller unit preferably includes a coil 93 located

within the reservoir 16. A heat exchange apparatus 94 communicates with and controls the temperature of the coil 93 thereby controlling the temperature of the water within the reservoir 16. The heat exchange apparatus 94 supplies coolant to the coil 93 via a heat exchange manifold assembly 95 shown in Figs. 1, [[8a and 8b]] 8A and 8B. Coolant is delivered to the manifold assembly 95 through a supply conduit 96 and enters the manifold through a manifold inlet 97. The coolant then passes out of the manifold via a heater/chiller supply port 98, through a conduit (not shown) and into the coil 93. After flowing through the coil 93, the coolant passes through another conduit (not shown) and back into the manifold 95 via a heater/chiller return port 99. The coolant then flows out of the manifold assembly via a heater/chiller return port 100, through a return conduit 101 and back into the heat exchange apparatus 94. A shutoff valve 102 controls the flow of coolant through the supply conduit 96. The coil 93 in each reservoir 16 may be associated with a separate heat exchange apparatus 94, or a single heat exchange apparatus 94 may control the temperature of each coil in the reservoirs 16. Any [[heart]] heat exchange apparatus known to those having skill in the art may be used in the system 10 of the present invention. For example, the heat exchange apparatus 94 may be an ElectraCOOL L-A400 thermoelectric chiller from Advanced Thermoelectric (Nashua, NH).

Please replace paragraph [0066] with the following amended paragraph:

[0066] A wide variety of other test organisms 64 are also available for use with the present invention, including but not being limited to rainbow trout (Oncorhynchus

mykiss); pink salmon (Oncorhynchus gorbuscha); crayfish (Orconectes sp.); minnow and carps (Cyprinidae); bullhead and catfish (Ictaluridae); sunfish (Centrarchidae); trout, salmon and whitefish (Salmonidae); crayfish; and aquatic insects and any other species appropriate for examining water pollutant effects. Any aquatic organism that can be placed in the exposure chamber 62 and provide an electrical signal may be used in the present invention. Juvenile bluegill are often the preferred choice as the species are widely available, are easily maintained over a wide range of temperature and pH levels, are relatively sensitive to a number of pollutants, and have large opercular flaps which elicit a strong ventilatory signal. Regardless of the choice of test organism, it is desirable to acclimate the organism to the experimental conditions prior to exposure and data collection.

Please replace paragraph [0072] with the following amended paragraph:

[0072] As illustrated in Fig. 10, a ventilatory signal includes a series of peaks 201-207 and troughs 208-209. Time is illustrated from left to right, with the most recent signal appearing on the far right of Fig. 10 near trough 209. Peak parameters used in this level one analysis include total duration, rear duration, peak-to-peak duration, apex, rear height, minimum height, and maximum height. A peak is defined as a signal maximum point (apex) where the difference between the value of the signal at the peak and the value of the signal at the immediately preceding or following trough is greater than a specified threshold 210. Step S301 in Fig. 11A begins signal monitoring for the next peak. The peak picking threshold 210 is generally never less than ten as measured on

the 0 to 4095 integer scale, but may be adjusted upward based upon the mean maximum peak height x__bar for the previous print interval as described below. Step S302 determines whether the maximum height is greater than or equal to [[10]] <u>ten</u>, and step S304 determines whether the same value is greater than or equal to ten percent of x__bar. If both conditions S302 and S304 are met, then the value is identified as a peak. If either one of these conditions is not met, or if both conditions are not met, then monitoring for the next peak is continued in step S303. In this way, low amplitude signals 211, which do not exceed the minimum threshold 210 are not labeled as peaks.

Please replace paragraph [0098] with the following amended paragraph:

[0098] Turning to Fig. 13, a schematic of a termination panel 140 is illustrated. Termination panel 140 includes signal module 410 and control module 420. Signal module 410 receives analog input from module 403 of internal carrier 400 via cable 414. Module 410 includes analog input terminal strip 413 and analog output terminal strip 415. Channel 0 and 1 of output terminal [[414]] <u>415</u> are used in this illustration to provide an analog voltage signal to oscilloscope 142 via cable 416. Channel 0 of input terminal 413 receives signal 418 from an external source indicating, for example, that a wastewater or effluent discharge is taking place. Additional terminals for further input data and output functions are provided for expansion as may be desired for a particular application of the invention. More information from a water treatment facility, for example, may be provided and analyzed by controller 32 via the unused channels available on input terminal 413. Similarly, additional output information could be

provided to remote sites, monitoring stations, and the like using the unused channels of output terminal 415.